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(56) Documents Cited  
GB 2334630 A GB 2209885 A

(58) Field of Search  
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Other: Online databases: EPODOC, JAPIO, WPI

## (54) Abstract Title Rotatable brush plate for reversible electric drill

(57) An electric drill has a motor whose direction of rotation is selectable by means of a selector lever 30 (fig. 1). Lever 30 includes a selector fork 38 which engages a pin 40 located on a brush plate 10 in a region close to the selector lever 30. The brush plate 10 is rotatably mounted on a housing base 42 and is moved by the selector lever 30 to provide the required direction of rotation of the motor. The assembly provides for particularly easy movement of the selector lever 30 between the rotational end positions of the brush plate 10. At the end positions, the brush plate 10 has low freedom of movement, which guarantees reliable contact with printed conductors 46, which are in sliding contact with the brush plate 10. Between its rotational end positions, the brush plate 10 is held in an axial direction 14 by a first holding means 18 which allows axial freedom of movement. In the end positions, a second holding means 16, 16' braces the brush plate 10 against the housing base 42 without axial play. The invention provides comfort of use for the operator, yet avoids erosion and failure of contact points.

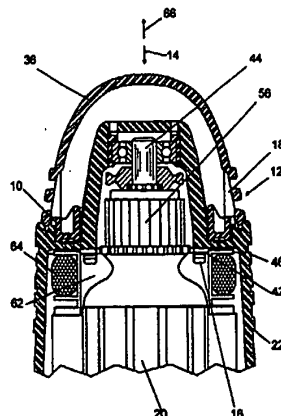


Fig. 3

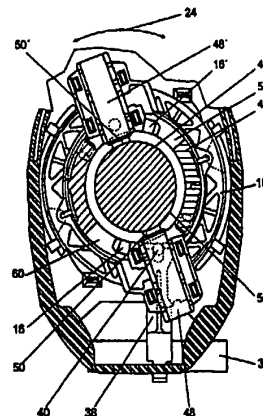


Fig. 4

GB 2 384 918 A



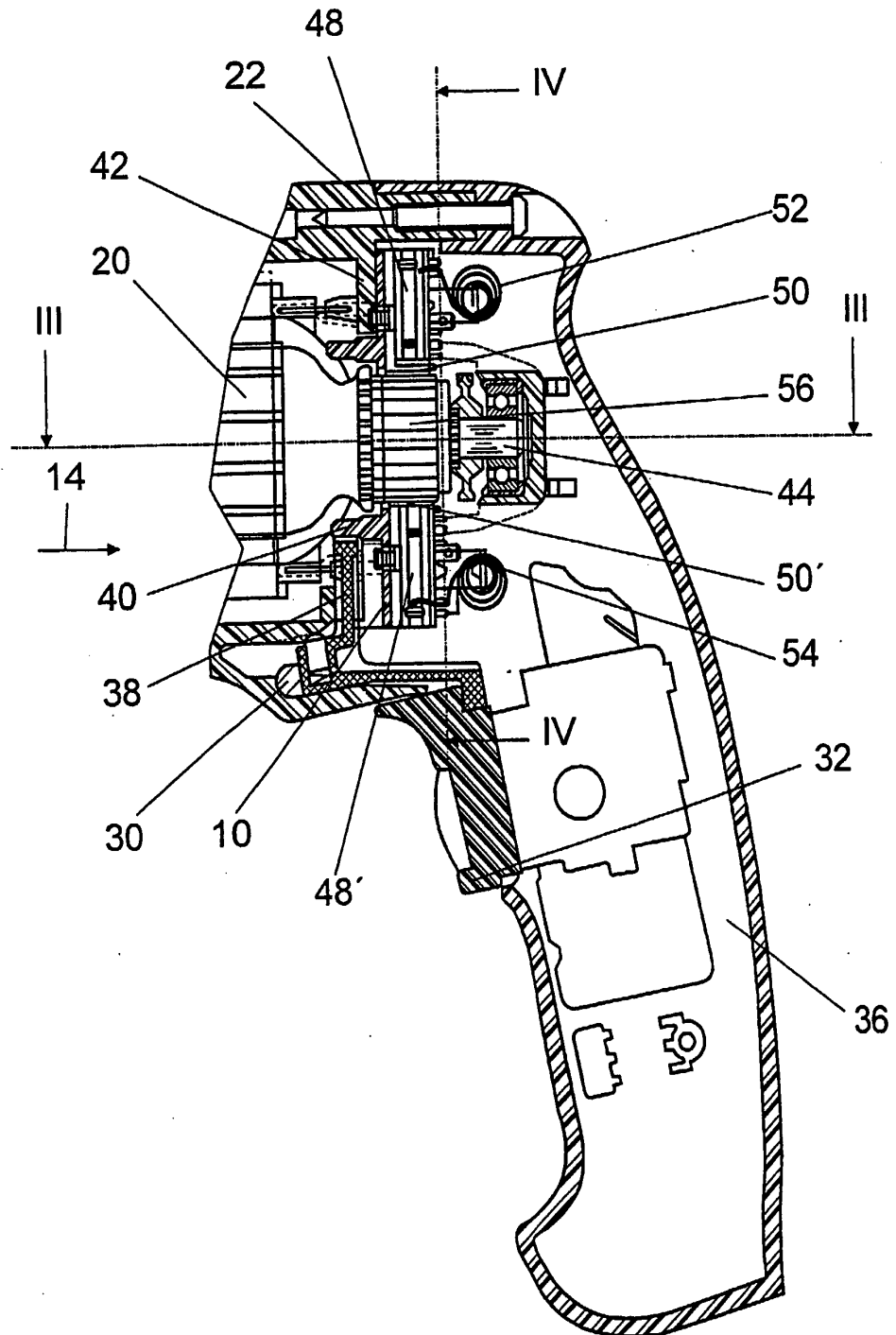


Fig. 2

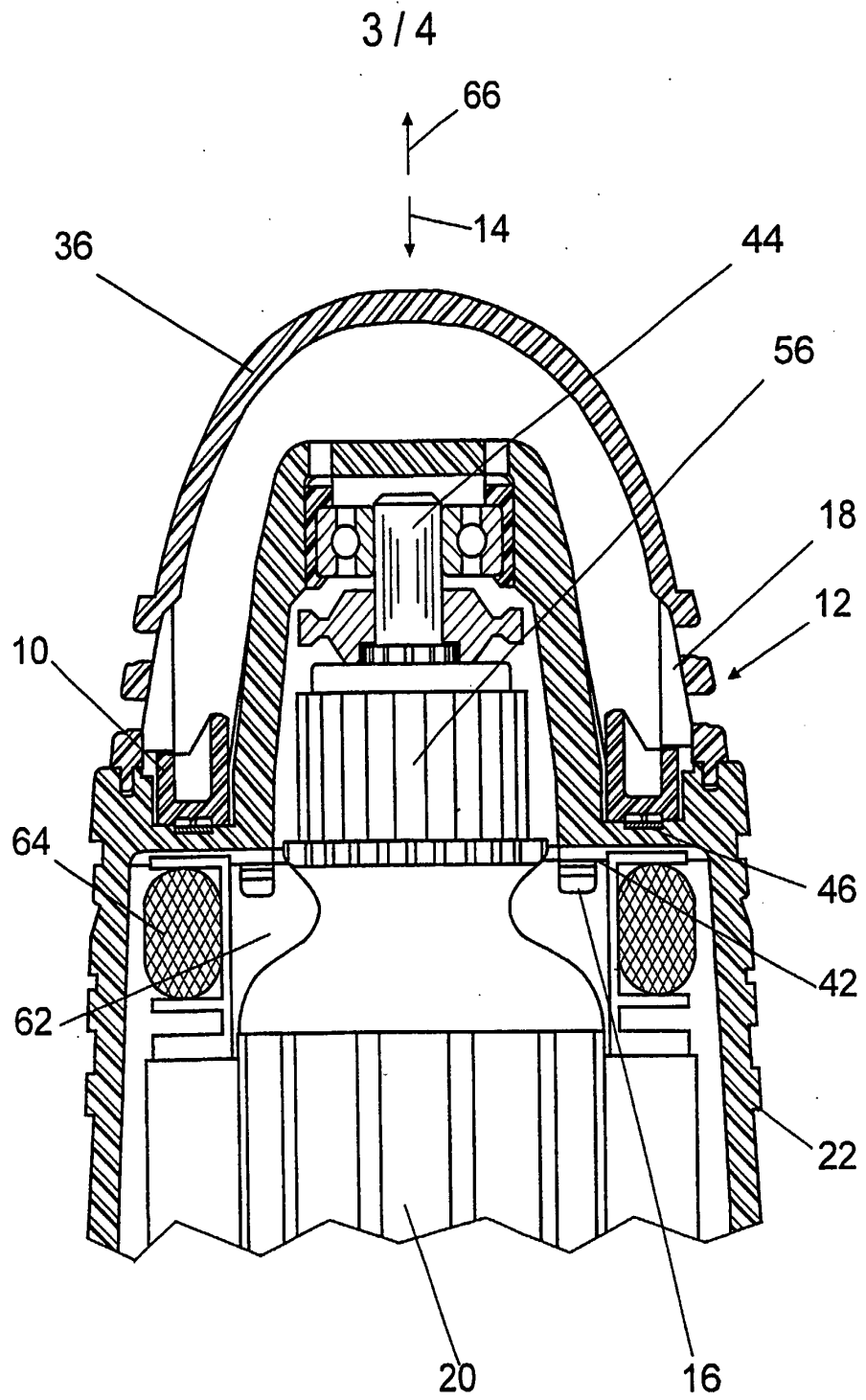


Fig. 3

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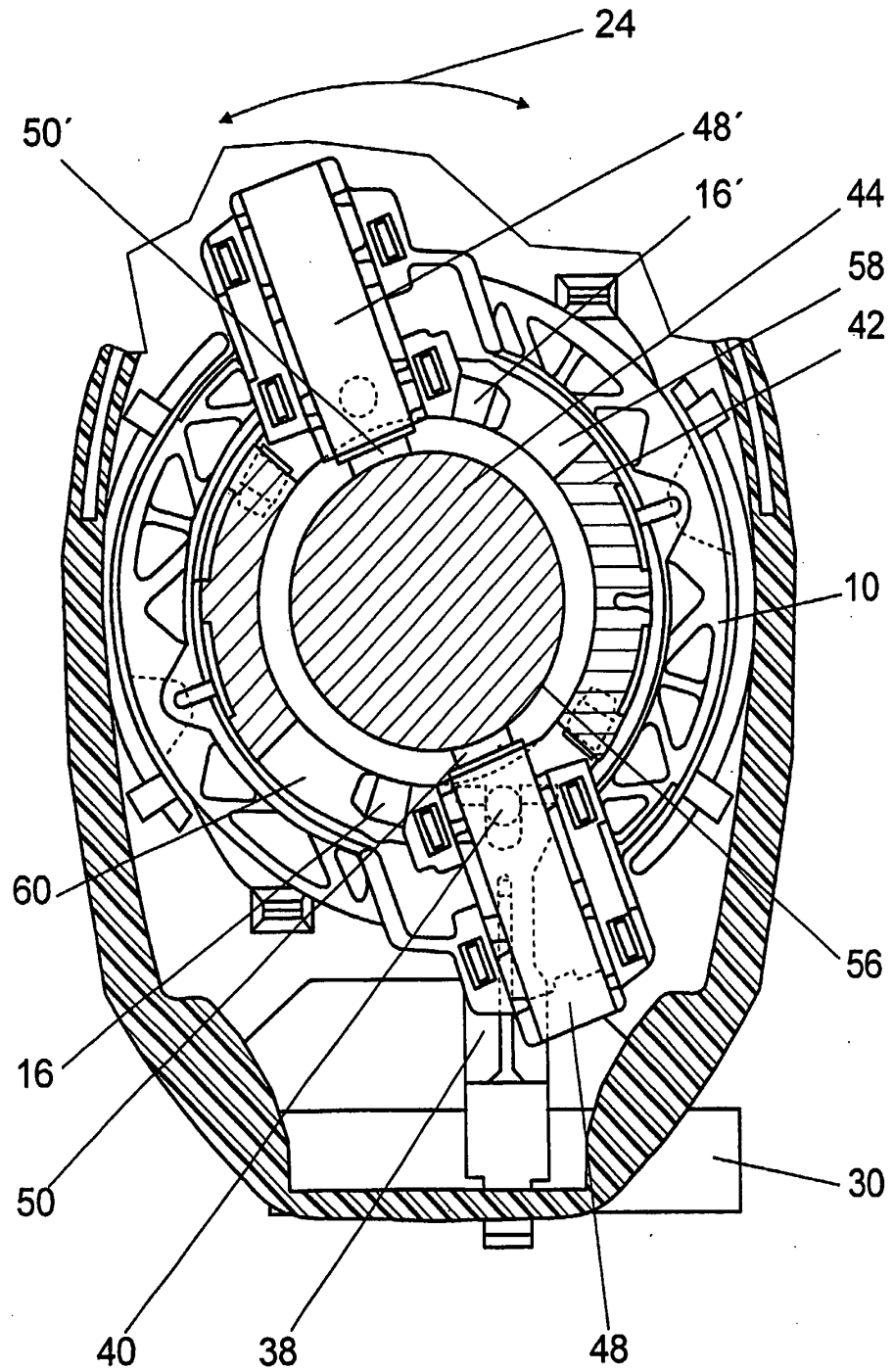


Fig. 4

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Electrical machine

Background art

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The invention proceeds from an electrical machine according to the preamble of claim 1.

In electrical machines having brush plates, which are  
15 mounted rotatably on a housing base of a housing part, it is known for said brush plates to be held in axial direction by means of a holding apparatus.

Advantages of the invention

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The invention proceeds from an electrical machine having a rotatable brush plate, which is held in axial direction by means of a holding apparatus.

25 It is proposed that the holding apparatus by at least one means holds the brush plate in its end positions with less axial freedom of movement than between the end positions. The brush plate may therefore be designed with particularly easy movement between its end positions, which increases  
30 operator comfort when reversing a running direction, particularly in an electrical hand tool machine. Despite high comfort it is possible in the end positions to achieve a particularly low freedom of movement of the brush plate and guarantee reliable contact with printed conductors,  
35 which are workingly connected by sliding contacts to the brush plate. Eroding of the contact points may be avoided and failure of the electrical machine may advantageously be prevented. Maintenance work may be reduced and costs may be lowered.

It is further proposed that the holding apparatus comprises at least one first means for the region between the end positions and at least one second means, separate from the first means, for the end positions. The means may  
5 advantageously be purposefully designed in each case for the individual function. When the first means holds the brush plate in a region between the end positions with axial freedom of movement, it is possible to achieve easy movement of the brush plate and increase operator comfort,  
10 particularly in the case of hand tool machines, the running direction of which is variable by means of a selector mechanism. The second means, on the other hand, may hold the brush plate in the latter's end positions without play or with slight axial freedom of movement. Eroding of  
15 contact points may advantageously be avoided and failure of the electrical machine may be prevented.

In a further development of the invention, it is proposed that the first means is disposed at a side of the brush  
20 plate remote from an armature winding. The first means may be disposed on a housing part, in particular on a handling element of a hand tool machine, and may hold the brush plate in a constructionally simple manner between the end positions in axial direction. Existing installation space  
25 may advantageously be utilized, and it is possible to achieve an apparatus, which is extremely easy to assemble and disassemble. Costs, particularly assembly costs, may be saved.

30 When the second means is formed by a hook, the brush plate may be braced advantageously against a component in a constructionally simple manner, without play or with slight axial freedom of movement. The use of a hook further allows the brush plate to be braced via small, space-saving  
35 contact surfaces. The brush plate may advantageously be released from its end positions with a low expenditure of force, and operator comfort may be increased.

The second means may be disposed on a housing part or on another component deemed meaningful by a person skilled in the art. However, when the second means is disposed on the brush plate, it is possible to achieve a constructionally  
5 simple and inexpensive apparatus, in which exclusively two components may cooperate for bracing purposes. The brush plate may therefore be fixed in axial direction with low tolerances. The second means may be fastened to the brush  
10 connections deemed meaningful by the person skilled in the art. However, when the second means is formed on the brush plate, additional components, assembly effort and costs may be spared.

15 When the second means is disposed in a radially inner region of the brush plate, existing installation space may be utilized and existing components may advantageously be used.

20 The second means advantageously engages in the end positions behind at least one part of a housing. The part may be formed by a part of a machine housing or by a part of a motor housing. Additional components and the tolerances occasioned thereby may be avoided. When the  
25 part is a part of the motor housing, the brush plate may advantageously be preassembled.

#### Drawings

30 Further advantages arise from the following description of drawings. An embodiment of the invention is illustrated in the drawings. The drawings, description and claims contain numerous features in combination. The person skilled in the art will advantageously consider the features also  
35 individually and combine them into meaningful further combinations.



The drawings show:

- Fig. 1 a diagrammatic side view of a drilling machine,
- 5 Fig. 2 a longitudinal section through the cutout II in Fig. 1,
- Fig. 3 a section along the line III-III in Fig. 2 and
- 10 Fig. 4 a section along the line IV-IV in Fig. 2.

#### Description of the embodiment

Fig. 1 shows a drilling machine having an electric motor, which is mounted in a housing 22 and of which the direction of rotation 24, and hence a direction of rotation of a tool 28 clamped in a tool holder 26, is selectable via a selector lever 30. The selector lever 30 is disposed above an actuating switch 32 of the drilling machine so that an operator using one hand may operate the actuating switch 32, switch the drilling machine on or off and select the desired direction of rotation 24 of the tool 28 by means of the selector lever 30. At an end of the drilling machine facing the tool holder 26 a first handle 34 extending at right angles to the operating direction is fastened to the housing 22. Disposed at an end of the housing 22 remote from the tool holder 26 is a second handle 36, which extends at right angles to the operating direction and forms a part of the housing 22.

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The selector lever 30 comprises a selector fork 38, which with its free end positively embraces an articulated pin 40 (Figs. 2 and 3). The articulated pin 40 is formed on a brush plate 10 in a bottom region close to the selector lever 30. The brush plate 10, which is mounted rotatably on a housing base 42, radially surrounds a rotor shaft 44.

35

The housing base 42 at its side facing the brush plate 10 has printed conductors 46, which press the brush plate 10 in axial direction 66 away from the tool holder 26 against a first means 18 of a holding apparatus 12 (Fig. 4). The  
5 brush plate 10 is held in axial direction 14 by the holding apparatus 12 and/or the holding apparatus 12 acts with a holding force in direction 14, wherein the holding apparatus 12 is formed by the first means 18 for the region between the end positions and by a second means 16,  
10 separate from the first means 18, for the end positions. The first means 18 is disposed at a side of the brush plate 10 remote from an armature winding 20 and is formed by axially extending webs, which are distributed over the circumference of the brush plate 10 and formed on an inside  
15 of the handle 36.

The second means 16, 16' is formed by, in each case, two hooks, which are disposed in the region of diagonally opposite brush holders 48, 48' and are formed on a radially  
20 inner region of the brush plate 10 and in a space-saving manner project into an interior space 62 of a winding overhang 64 (Fig. 3 and Fig. 4). In the end positions of the brush plate 10, in each case two diagonally opposite hooks engage behind a part of the housing 22, namely the  
25 housing base 42, and brace the brush plate 10 against the housing base 42 without play, whereas the first means 18 holds the brush plate 10 between the end positions in axial direction 14 with axial freedom of movement. Between the end positions the hooks move freely in recesses 58, 60 of  
30 the housing base 42.

In principle, the brush plate might be braced in axial direction without freedom of movement in its end positions also by means of oblique surfaces. The oblique surfaces  
35 may be formed on the side of the brush plate facing the first means or on the brush plate and on the first means.

The brush holders 48, 48' have recesses, which are not shown in detail, for receiving carbon brushes 50, 50'. The carbon brushes 50, 50' are pressed by spring elements 52, 54 radially inwards onto a commutator 56 (Fig. 2 and Fig. 4).

In a first operating position, the brush plate 10 is situated in a first end position and the second means 16 fixes the brush plate 10 without play on the housing base 42. When the operator actuates the selector lever 30, the brush plate 10 is rotated by means of the selector fork 38 and the articulated pin 40 in direction of rotation 24. The second means 16 disengages, and the brush plate 10 is held in axial direction 14 with greater axial freedom of movement by the first means 18 of the holding apparatus 12 up to attainment of the second end position. In the second end position the brush plate 10 is once more held in axial direction 14 without play by the second means 16'.

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Reference characters

	10	brush plate	56	commutator
10	12	holding apparatus	58	recess
	14	axial direction	60	recess
	16	means	62	interior space
	18	means	64	winding overhang
	20	armature winding	66	direction
15	22	housing		
	24	direction of rotation		
	26	tool holder		
	28	tool		
	30	selector lever		
20	32	actuating switch		
	34	handle		
	36	handle		
	38	selector fork		
	40	articulated pin		
25	42	housing base		
	44	rotor shaft		
	46	printed conductor		
	48	brush holders		
	50	carbon brushes		
30	52	spring element		
	54	spring element		

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Claims

1. Electrical machine having a rotatable brush plate  
10 (10), which is held in axial direction (14) by means  
of a holding apparatus (12), **characterized in that** the  
holding apparatus (12) by at least one means (16)  
holds the brush plate (10) in its end positions with  
15 less axial freedom of movement than between the end  
positions.
2. Electrical machine according to claim 1, **characterized  
in that** the holding apparatus (12) comprises at least  
one first means (18) for the region between the end  
20 positions and at least one second means (16), separate  
from the first means (18), for the end positions.
3. Electrical machine according to claim 2, **characterized  
in that** the first means (18) is disposed at a side of  
25 the brush plate (10) remote from an armature winding  
(20).
4. Electrical machine according to claim 2 or 3,  
**characterized in that** the second means (16) is formed  
30 by at least one hook.
5. Electrical machine according to claim 4, **characterized  
in that** the second means (16) in the end positions of  
the brush plate (10) engages behind at least one part  
35 of a housing (22).

6. Electrical machine according to one of claims 2 to 5,  
**characterized in that** the second means (16) is  
disposed on the brush plate (10).
- 5 7. Electrical machine according to claim 6, **characterized**  
**in that** the second means (16) is formed on the brush  
plate (10).
8. Electrical machine according to claim 6 or 7,  
10 **characterized in that** the second means (16) is  
disposed in a radially inner region of the brush plate  
(10).
9. Hand tool machine having an electrical machine  
15 according to one of the preceding claims.
10. Electrical machine substantially as herein described  
with reference to the accompanying drawings.
- 20 11. Hand tool machine substantially as herein described  
with reference to the accompanying drawing.



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Application No: GB 0224675.9  
Claims searched: 1 - 11

Examiner: Bill Riggs  
Date of search: 2 June 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 at least	GB 2209885 A (Metabowerke GmbH) see particularly p.6 ll.15-20 & p.12
A		GB 2334630 A (Scintilla AG) see whole document

### Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>V</sup>:

H2A

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

H01R, H02K

The following online and other databases have been used in the preparation of this search report:

Online databases: EPODOC, JAPIO, WPI